

# Geltech Precision Molded Aspheric Lenses

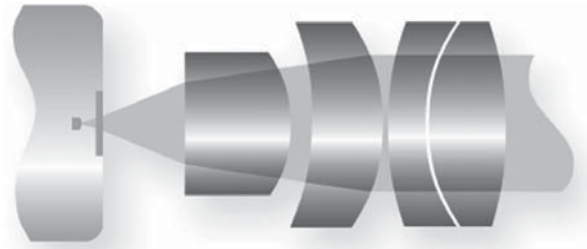
## MODERN LENSES FOR MODERN APPLICATIONS

For today's most sophisticated and compact laser systems, aspheres are the most powerful lenses for managing laser light. In these systems, spherical aberration is the most prevalent performance detractor. It arises from the use of spherical surfaces and artificial limits focusing and collimating accuracy.

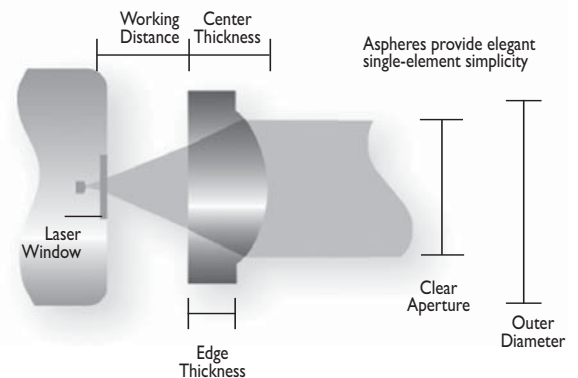
Although it has been known for centuries that spherical geometry is not optimal for refracting light, the expense of fabricating non-spherical (aspheric) surfaces has inhibited their use. With the breakthrough of LightPath's glass molding technology, this optimal lens geometry has become a reality.

Molded lenses are used in a variety of photonics products: barcode scanners, laser diode to fiber couplings, optical data storage, and medical lasers, to name a few. In many of these applications, the material of choice is optical glass because of its durability and performance stability over a wide environmental range. High power transmittance is also an added advantage.

### Spherical System



### Aspherical Lens



### Did you know...

That asphere optics from LightPath can actually improve system performance and lower overall cost?

The benefits of glass molding technology become apparent when traditional methods of grinding and polishing become cost-prohibitive. The direct molding process eliminates the need for any grinding or polishing, offering aspheric lenses at practical prices for system designers. Molding is the most consistent and economical way to produce aspheres in large volumes.

## GUARANTEED PERFORMANCE

LightPath's aspheric lenses are inspected and optically tested to ensure complete customer satisfaction. Visual cosmetic inspection for scratch/dig is performed on 100% of all lenses per MIL-PRF-13830B. Most lenses are guaranteed to pass 40/20 scratch/dig, but other inspection criteria, such as 60/40 or 20/10, can be provided upon request.

# Performance and Customization

## DIFFRACTION LIMITED PERFORMANCE

The primary optical specification is the root-mean-squared transmitted wavefront error (RMS WFE). It is measured on a phase shift interferometer at the wavelength of 632.8nm. Most of our lenses are guaranteed to be diffraction limited, which means the RMS WFE  $< 0.070 \lambda$  at the design wavelength.



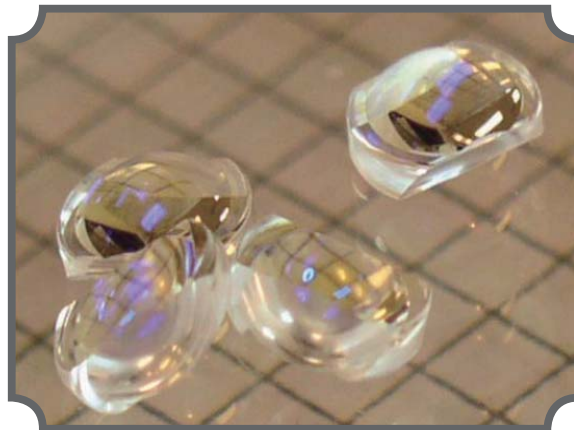
Several of our standard lenses are available pre-mounted in metal holders. Using our unique Mold-In-Place (MIP) technology, we can mold the lens directly inside a steel holder, eliminating the need for adhesives. We can also epoxy our lenses into stainless steel or Kovar mounts so you can weld them directly into your system.

## NUMERICAL APERTURE

Our molded aspheric lenses are available with numerical apertures ranging from 0.15 up to 0.77. Lower numerical apertures are best when a large depth of focus is important or when you need nearly circular beams. Applications that would use a low numerical aperture include bar code scanners, surveying instruments, and small weapons sights. High numerical aperture lenses are important when you need the maximum light capture from a diode laser. High numerical aperture applications include data storage and industrial printing.

## SHAPES AND SIZES

With lenses available in a multitude of shapes and sizes, up to 22mm in diameter, LightPath will be able to provide you with the perfect lens for your unique application.



## DIFFRACTIVE HYBRID LENSES

By combining a refractive aspheric lens with a diffractive feature on one surface, you can achieve sophisticated beam shaping of your laser light. You can also use diffractive hybrid lenses to make your system achromatic over a range of wavelengths. LightPath hybrid lenses are custom designed to each particular application.

## CHOOSE FROM A VARIETY OF FORM FACTORS FOR CUSTOM DESIGNS

LightPath's unique molding process allows us to custom manufacture a lens based on your specific requirements. We can provide lenses in a number of different form factors from a simple aspheric lens, to a wafer-based lens and even a lens molded into a metal housing. Some of LightPath's lens molding capabilities include:

- Wafer Lenses
- Anamorphic Lenses
- Molded-in-Place
  - Cylindrical Metal Holders
  - Square Holders
  - T-Holders
  - Custom Holders



# STANDARD ASPHERIC DESIGNS

## HIGH-PERFORMANCE OPTICS FOR A VARIETY OF APPLICATIONS

- Benefit from the quality and performance of all-glass aspheres
- Easily transition from prototype phase to high-volume production
- Customize to fit your application or choose from over 100 standard aspheric designs
- RoHS-compliant, ultra-high quality glass

Aspheric lenses are known for their optimal performance but the expense of fabricating them has inhibited their use. LightPath's glass molding technology has enabled high volume production of aspheric optics while maintaining the highest quality at an affordable price. Because molding is the most consistent and economical way to produce aspheres in large volumes, LightPath has perfected this method to offer the most precise aspheric lens available. LightPath offers standard and custom-made lenses, all designed by our expert optical design engineers.

Geltech Asphere Performance Parameters					
Lens Code	Focal Length (mm)	Numerical Aperture	Outer Diameter (mm)	Working Distance (mm)	Page
355631	0.39	0.55 / 0.13	1.20	0.284 / 1.902	10
355070	0.43	0.06 / 0.66	1.20	5.00 / 0.270	10
355485	0.55	0.50 / 0.10	1.00	0.30 / 3.030	10
355487	0.55	0.50 / 0.11	1.00	0.276 / 2.940	10
355536	0.60	0.60	1.24	0.22	10
355880	0.70	0.60	2.50	0.33	10
355840	0.75	0.47	3.00	0.43	10
355915	0.80	0.12 / 0.50	1.30	3.931 / 0.669	10
355960	1.00	0.62	1.824	0.24	10
355200	1.14	0.43 / 0.124	2.40	4.81	10
355201	1.14	0.124 / 0.430	4.93	1.129 / 4.809	11
354450	1.16	0.30 / 0.30	1.80	1.67 / 1.67	11
357786	1.41	0.502	2.00	1.20	11
356785	1.42	0.62	2.75	0.86	11
354140	1.45	0.58	2.40	0.81	11
354710	1.49	0.53	2.65	1.02	11
355950	1.81	0.37	3.00	1.089	11

Geltech Asphere Performance Parameters					
Lens Code	Focal Length (mm)	Numerical Aperture	Outer Diameter (mm)	Working Distance (mm)	Page
355755	1.94	0.15 / 0.15	1.70	3.570 / 3.570	11
355150	2.00	0.5	3.00	1.4	11
355151	2.00	0.504	3.00	1.029	11
355410	2.51	0.20	1.805	1.84	12
355615	2.51	0.201	2.05	1.731	12
355945	2.51	0.317	3.00	1.761	12
356300	2.54	0.66	4.00	1.55	12
355160	2.73	0.55	4.00	2.37	12
355390	2.75	0.55	4.50	2.16	12
355440	2.76	0.52 / 0.26	4.70	7.090 / 2.713	12
355392	2.80	0.6	4.00	1.5	12
355660	2.976	0.52	4.00	1.56	12
354330	3.10	0.7	6.325	1.8	13
355330	3.10	0.77	6.325	1.59	13
353515	3.50	0.4	3.00	2.3	13
355545	3.50	0.38	3.50	2.3	13
355970	3.70	0.21	1.80	3.030	13

# STANDARD ASPHERIC DESIGNS

Geltech Asphere Performance Parameters

Lens Code	Focal Length (mm)	Numerical Aperture	Outer Diameter (mm)	Working Distance (mm)	Page
352080	3.89	0.547	6.325	2.71	13
357775	4.00	0.6	6.325	2.4	13
357610	4.00	0.616	6.325	2.691	13
357765	4.00	0.61	6.325	2.37	13
355940	4.02	0.17	3.00	3.37	13
354340	4.03	0.64	6.325	2.68	14
355022	4.47	0.47	5.42	3.08	14
354350	4.50	0.4	4.70	2.2	14
354996	4.50	0.30	3.00	3.46	14
355230	4.50	0.55	6.325	3.08	14
354453	4.60	0.5	6.00	2.7	14
354430	5.00	0.15	2.00	4.37	14
354105	5.50	0.6	7.20	3.7	14
354130	6.00	0.21	3.00	4.90	14
354550	6.10	0.18	2.79	4.87	14
354171	6.20	0.30	4.70	4.10	15
355110	6.20	0.4	7.20	3.5	15
353525	6.70	0.5	6.325	4.9	15
354115	6.80	0.5	9.20	4.3	15

Geltech Asphere Performance Parameters

Lens Code	Focal Length (mm)	Numerical Aperture	Outer Diameter (mm)	Working Distance (mm)	Page
355375	7.50	0.3	6.51	5.8	15
354240	8.00	0.5	9.936	5.9	15
354060	9.60	0.30	6.325	8.13	15
354306	9.90	0.3	6.335	8.4	15
354125	10.00	0.5	11.00	7.8	15
355561	10.00	0.6	15.00	7.0	15
354220	11.00	0.3	7.20	7.9	16
354061	11.00	0.24	6.325	9.56	16
354062	11.00	0.24	6.00	9.66	16
354064	11.00	0.2	6.00	9.3	16
355397	11.00	0.3	7.20	10.0	16
354058	12.00	0.22	6.325	10.57	16
354057	13.00	0.20	6.325	11.58	16
354560	13.86	0.18	6.325	12.11	16
354059	14.00	0.19	6.325	12.63	16
354120	15.04	0.15	4.985	13.19	16
354260	15.29	0.16	6.50	13.98	17
354280	18.40	0.15	6.50	17.11	17
354850	22.00	0.13	6.325	20.41	17

# STANDARD ANTI-REFLECTIVE COATINGS

## STANDARD ANTI-REFLECTIVE COATINGS

LightPath offers a variety of multilayer broadband coatings to reduce the back reflection from a nominal 6% for uncoated lenses. The choice of which AR coating is appropriate depends on the type of glass the lens is made from and the wavelength at which the lens will be used.

Standard Coatings*			
Lens Series	Coating	$\lambda$ Range (nm)	Reflectivity
352xxx, 353xxx, 354xxx, 355xxx	MLBB-A	350 - 700	$R_{avg} \leq 0.50\%$
352xxx, 354xxx, 355xxx	MLBB-B	600 - 1050	$R_{max} < 1.00\%$
352xxx, 354xxx, 355xxx	MLBB-C	1050 - 1600	$R_{max} < 1.00\%$
355xxx	MLBB-Q	1300 - 1700	$R_{max} < 0.25\%$
356xxx, 357xxx	UVA	350 - 500	$R_{max} < 1.00\%$

\* LightPath's rigorous qualification process ensures all standard coatings will pass the abrasion and adhesion resistance requirements of ISO+9211-4-196.

## Typical Coating Curves

